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VERIFICATION OF A TRANSLATION

I, the below named translator, hereby declare that:

My name and post office address are stated below;

That I am knowledgeable in English and Japanese languages and that I believe the following is a true and complete translation into English language of Certificate of Japanese Patent Application No.2002-182923 filed in the Japan Patent Office on June 24, 2002.

Signed this 7th day of December, 2006

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[Document Name] Specification 1

[Document Name] Drawings 1

[Document Name] Abstract 1

[Proofing of Data] Requested

[Document Name] SPECIFICATION

[Title of the Invention] ROTATION DETECTION APPARATUS

[Scope of Claim for Patent]

[Claim 1]

(a) A rotation detecting apparatus to be attached to an analog record player having a turntable for rotating an analog record having an audio signal recorded thereon, the apparatus comprising:

(b) detecting means for detecting a rotation speed and rotation direction of the analog record or a similar disk rotated by the turntable; and

(c) rotation information output means connected to the detecting means, for outputting rotation speed data and rotation direction data to an outside of the analog record player.

[Claim 2]

The rotation detection apparatus according to claim 1, wherein the detecting means includes:

(a) a rotation body that is brought into contact with the analog record or the similar disk and is thus rotated; and

(b) a rotary encoder for detecting a rotation speed and rotation direction of the rotation body.

[Claim 3]

The rotation detection apparatus according to any one of claims 1 and 2, further comprising a supporting means capable of switching a position of the detecting means between a first position, in which the detecting means is in contact with the analog record or the similar disk, and a second position, in which the detecting means is away from the analog record or the similar disk.

[Claim 4]

The rotation detection apparatus according to claim 1, wherein the detecting means includes:

(a) an image sensor for capturing a surface of the analog record or the

similar disk in the form of image data; and

(b) a calculation section for calculating the rotation speed and rotation direction of the analog record or the similar disk based on change of the image data.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a rotation detection apparatus to be attached to an analog record player equipped with a turntable for rotating an analog record having an audio signal recorded thereon, for detecting a rotation speed and rotation direction of the analog record or a similar disk.

[0002]

[Conventional Art]

There is known a scratch operation of forcibly rotating the analog record on the turntable of the analog record player by hand to change the rotation speed or rotation direction of the analog record, thereby generating special sound effects. In recent years, there is known, for example, a scratch reproduction method in which a jog dial or the turntable of the analog record player is subjected to the scratch operation and thereby audio data for another electronic device is controlled and reproduced. For example, there is known a scratch reproduction method in which a dedicated analog record having time codes recorded thereon is mounted on the turntable of the analog record player, the dedicated analog record is reproduced using a regular cartridge, and audio data in a computer is controlled based on the time codes.

[0003]

[Problems to be Solved by the Invention]

Such a conventional scratch reproduction method has a problem in that the dedicated analog record having the time codes recorded thereon should be mounted on the turntable, which involves a troublesome operation. In addition, the conventional scratch reproduction method has a problem in that if the dedicated

analog record is mounted on the turntable, an analog record having audio data recorded thereon cannot be mounted on the turntable for reproduction of the audio data. Further, the conventional scratch reproduction method has a problem in that it is impossible to switch the dedicated analog record having the time codes recorded thereon and the analog record having the audio data recorded thereon from one to the other in an instant.

[0004]

An object of the present invention is to provide a rotation detection apparatus that makes it possible to easily control audio data for another electronic device using an analog record having audio data recorded thereon.

[0005]

[Means for Solving the Problems]

The present invention solves the above problems by the following solutions.

An invention of claim 1 is a rotation detecting apparatus to be attached to an analog record player having a turntable for rotating an analog record having an audio signal recorded thereon, the apparatus including: detecting means for detecting a rotation speed and rotation direction of the analog record or a similar disk rotated by the turntable; and rotation information output means connected to the detecting means, for outputting rotation speed data and rotation direction data to an outside of the analog record player.

[0006]

An invention of claim 2 is the rotation detection apparatus according to claim 1, wherein the detecting means includes: a rotation body that is brought into contact with the analog record or the similar disk and is thus rotated; and a rotary encoder for detecting a rotation speed and rotation direction of the rotation body.

[0007]

An invention of claim 3 is the rotation detection apparatus according to any one of claims 1 and 2, further including a supporting means capable of

switching a position of the detecting means between a first position, in which the detecting means is in contact with the analog record or the similar disk, and a second position, in which the detecting means is away from the analog record or the similar disk.

[0008]

An invention of claim 4 is the rotation detection apparatus according to claim 1, wherein the detecting means includes: an image sensor for capturing a surface of the analog record or the similar disk in the form of image data; and a calculation section for calculating the rotation speed and rotation direction of the analog record or the similar disk based on change of the image data.

[0009]

[Embodiments of the Invention]

(First Embodiment)

Hereinafter, with reference to the accompanying drawings, a first embodiment of the present invention will be described in detail.

FIG. 1 is a diagram illustrating a structure of a scratch reproduction system equipped with a rotation detection apparatus according to the first embodiment of the present invention.

A scratch reproduction system 1 is a system that controls audio data to be reproduced by a data reproduction apparatus 3 in accordance with a scratch operation performed on an analog record player 5. As illustrated in FIG. 1, the scratch reproduction system 1 includes an optical disk 2, the data reproduction apparatus 3, an analog record 4, the analog record player 5, and a rotation detection apparatus 6.

[0010]

The optical disk 2 is a compact disk, a mini disk having a diameter of 64 mm, or the like having audio data recorded thereon. The data reproduction apparatus 3 is a device for reproducing the audio data recorded on the optical disk 2. The data reproduction apparatus 3 includes: a spindle motor 3a for rotating the

optical disk 2; an optical head 3b for reading the audio data recorded on the optical disk 2; a signal processing circuit 3c for processing a signal outputted from the optical head 3b; a memory (RAM) 3d for storing the audio data outputted from the signal processing circuit 3c; an address control section 3e for generating an address used to read the audio data stored in the memory 3d based on a signal outputted from the rotation detection apparatus 6; a memory control section 3f for reading the audio data from the memory 3d based on the address and outputting it; a signal processing circuit 3g for converting a digital signal outputted from the memory control section 3f into an analog signal; and an output terminal 3h for outputting the analog signal.

[0011]

The analog record 4 is an analog disk (a phonograph record) having recorded thereon audio data in the form of grooves. The analog record player 5 is a device for reproducing the audio data recorded on the analog record 4. The analog record player 5 includes: a turntable 5a on which the analog record 4 is mounted and rotated; a mat 5b that is sandwiched between the turntable 5a and the analog record 4; a head shell 5c to which a phonograph needle is attached; and a tone arm 5d that detachably supports the head shell 5c and rotates horizontally. The analog record player 5 is placed with the tone arm 5d located most distant from a performer, such as a disk jockey (DJ), so that the performer can perform a scratch operation on the analog record 4 without hindrance. Note that depending on the performer, the analog record player 5 may be placed in the normal manner, i.e., with the tone arm to the right.

[0012]

FIG. 2 illustrates the analog record player to which the rotation detection apparatus according to the first embodiment of the present invention is attached. FIG. 2(A) is a plan view, and FIG. 2(B) is a front view. FIG. 3 is a perspective view of the rotation detection apparatus according to the first embodiment of the present invention. FIG. 4 is a plan view of the rotation detection apparatus

according to the first embodiment of the present invention. FIG. 5 is a side view of the rotation detection apparatus according to the first embodiment of the present invention. FIG. 6 is a front view of the rotation detection apparatus according to the first embodiment of the present invention when it is in operation (ON) for detection. FIG. 7 is a front view of the rotation detection apparatus according to the first embodiment of the present invention when it is not in operation (OFF) for detection. FIG. 7(A) is a plan view illustrating the shape of a shell stand hole of the turntable, FIG. 7(B) is a front view illustrating a state in which the rotation detection apparatus is fitted into the shell stand hole, and FIG. 7(C) is a bottom plan view of the rotation detection apparatus.

[0013]

The rotation detection apparatus 6 is a device for detecting the scratch operation for the analog record 4 having the audio data recorded thereon. As illustrated in FIGS. 2 to 7, the rotation detection apparatus 6 includes a base 7, a chassis 8, a detecting section 9, and a switching section 10. The base 7 is a member that is detachably attached to the analog record player 5. The base 7 is a columnar metallic member which is large in mass, and as illustrated in FIGS. 6 and 7, at a lower part of the base 7, a fitting pin 6a to be fitted into a shell stand 5e is formed. As illustrated in FIGS. 7(B) and 7(C), the fitting pin 6a is press-fitted into a projection part 7a formed in the center of the bottom of the base 7, and a tip of the fitting pin 6a protrudes from a side of the projection part 7a. In the turntable 5, as illustrated in FIG. 7(A), the shell stand 5e to which the head shell 5c is to be attached in a detachable manner is formed. A fitting hole 5f into which the projection part 7a is to be fitted is formed in the shell stand 5e, and an engaging groove 5g with which the fitting pin 6a is engaged is formed on an inside wall surface of the fitting hole 5f. The chassis 8 is a member for joining a supporting element 10a with the base 7, and as illustrated in FIG. 4, it is secured to the base 7 by a screw 8a. In the chassis 8, through holes 8c and 8d through which supporting shafts 10b and 10c pass are formed.

[0014]

The detecting section 9 is a device for detecting the rotation speed and rotation direction of the analog record 4. The detecting section 9 outputs rotation speed data and rotation direction data which are used to control the audio data outputted by the data reproduction apparatus 3 as illustrated in FIG. 1. The detecting section 9 is detachably placed on the analog record player 5, at a position that does not interfere with the performer's scratch operation on the analog record 4. As illustrated in FIGS. 4 to 7, the detecting section 9 includes a rotation body 9a and a rotary encoder 9b.

[0015]

The rotation body 9a is a member that comes into contact with the analog record 4 and thus rotates. The rotation body 9a includes a roller section 9c, a slip preventing element 9d, and a shaft element 9f. The roller section 9c is a cylindrical member formed of a synthetic resin such as plastic. The slip preventing element 9d is, for example, a ring-shaped rubber member that, when in contact with a peripheral thick portion (groove guard) 4a of the analog record 4, increases a frictional force against the thick portion 4a. The slip preventing element 9d is attached along an outer surface of the roller section 9c. A shaft 9e is a rotation axis that passes through the center of the shaft element 9f, which is integral with the roller section 9c.

[0016]

The rotary encoder 9b is a device for detecting the rotation speed and rotation direction of the rotation body 9a. The rotary encoder 9b includes an encoder disk 9g and a photo-interrupter 9h. As illustrated in FIG. 5, black stripes 9i printed in a circumferential direction on a disk-shaped polyester film and an engaging hole 9j to be engaged with the shaft element 9f are formed in the encoder disk 9g. The encoder disk 9g is secured to the shaft element 9f by an adhesive or the like so as to rotate with the roller section 9c in a united body. The photo-interrupter 9h is an optical to electrical conversion element for converting an

optical signal to an electrical signal. The photo-interrupter 9h is secured to the supporting element 10a by screws 9k and 9m so that the black stripes 9i of the encoder disk 9g pass between a light-emitting element and a light receiving element. The photo-interrupter 9h generates a two-phase pulse signal when the encoder disk 9g is rotated, and detects the rotation direction based on a phase difference of the pulse signal and the rotation speed based on a pulse width of the pulse signal. The photo-interrupter 9h outputs the detected rotation speed data and rotation direction data to the address control section 3e as illustrated in FIG. 1.

[0017]

The switching section 10 is a device for switching between on and off states of the detection operation of the detecting section 9. As illustrated in FIG. 4, the switching section 10 includes the supporting element 10a and the supporting shafts 10b and 10c. The supporting element 10a is a plane-shaped member for supporting the detecting section 9. In the supporting element 10a, through holes 10d and 10e through which the supporting shafts 10b and 10c pass are formed, and an end of a shaft 10f is fixed to the supporting element 10a. As illustrated in FIGS. 6 and 7, the supporting element 10a switches its position between a rotary position P_1, which causes the rotation body 9a to be in contact with the analog record 4, and a rotary position P_2, which causes the rotation body 9a to be away from the analog record 4. The supporting shafts 10b and 10c are members for rotatably joining the supporting element 10a and the chassis 8 together, and serve as axes when the supporting element 10a rotates.

[0018]

Next, an operation of the rotation detection apparatus according to the first embodiment of the present invention will now be described below.

As illustrated in FIGS. 4 and 6, when the supporting element 10a has been rotated around the supporting shafts 10b and 10c into the rotary position P_1, the slip preventing element 9d is brought into close contact with the thick portion 4a of the analog record 4 because of weight of the supporting element 10a and the like. As

a result, the frictional force between the slip preventing element 9d and the analog record 4 allows the rotation body 9a to be rotatable in accordance with the analog record 4, whereby the detecting section 9 switches from the Off state to the On state for the detection operation. If the performer performs the scratch operation on the analog record 4 while the turntable 5a is rotated and the analog record 4 is reproduced, the rotation body 9a rotates around the shaft 9e in accordance with the rotation of the analog record 4.

[0019]

If the rotation body 9a rotates, the rotary encoder 9b detects the rotation speed and rotation direction of the rotation body 9a, and outputs the rotation speed data and the rotation direction data to the address control section 3e as illustrated in FIG. 1 in the form of the pulse signal. If the address control section 3e performs address control on the memory control section 3f based on the pulse signal, the memory control section 3f controls a reading speed and a reading direction of the audio data stored in the memory 3d, whereby the audio data in the data reproduction apparatus 3 is subjected to scratch control. On the other hand, as illustrated in FIGS. 4 and 7, if the supporting element 10a is rotated around the supporting shafts 10b and 10c into the rotary position P_2, the rotation body 9a leaves the thick portion 4a of the analog record 4, whereby the detecting section 9 switches from the On state to the Off state for the detection operation.

[0020]

If the performer performs the scratch operation on the analog record 4 being reproduced while the rotation body 9a is in contact with the analog record 4 as illustrated in FIG. 6, the analog record 4 is subjected to the scratch reproduction and at the same time the data reproduction apparatus 3 subjects the audio data to the scratch reproduction in synchronization with the performer's scratch operation. In the case where the performer performs the scratch operation without reproducing the analog record 4, the data reproduction apparatus 3 subjects the audio data to the scratch reproduction in synchronization with the performer's scratch operation.

On the other hand, if the performer performs the scratch operation on the analog record 4 being reproduced while the rotation body 9a is away from the analog record 4 as illustrated in FIG. 7, only the analog record 4 is subjected to the scratch reproduction while the data reproduction apparatus 3 reproduces the audio data in the regular manner.

[0021]

The rotation detection apparatus according to the first embodiment of the present invention produces effects as described below.

(1) In the first embodiment, the rotation speed and the rotation direction of the analog record 4 having the audio data recorded thereon are detected by the detecting section 9, and this detecting section 9 outputs the rotation speed data and the rotation direction data to be used for the control of the audio data outputted by the data reproduction apparatus 3. As a result, it becomes possible to control the audio data in the data reproduction apparatus 3 only by performing the scratch operation on the analog record 4 having the audio data recorded thereon, without employing the dedicated analog record having the time codes recorded thereon as in the conventional scratch reproduction method. Moreover, because there is no need to mount the dedicated analog record on the turntable 5a, it is possible to reproduce the audio data recorded on the optical disk 2 using the data reproduction apparatus 3 while reproducing the analog record 4 having the audio data recorded thereon.

[0022]

(2) In the first embodiment, the rotation body 9a is brought into contact with the analog record 4 and is thus rotated, and the rotation speed and the rotation direction of the rotation body 9a are detected by the rotary encoder 9b. As a result, it becomes possible to easily construct and cheaply manufacture the rotation detection apparatus 6 and easily attach it to the existing analog record player 5. Moreover, because there is no need to reproduce the dedicated analog record having time data recorded thereon using the phonograph needle as in the

conventional scratch reproduction method, it is possible to prevent the phonograph needle from being worn.

[0023]

(3) In the first embodiment, the analog record player 5 as it is can be used also as a means of scratch operation for the data reproduction apparatus 3. This means that an extremely convenient user interface is provided to performers who are skilled in the scratch operation for the analog record player. Moreover, it is possible to reproduce music data from the data reproduction apparatus 3 while reproducing the analog record using the analog record player 5. Thus, by performing the scratch operation on the analog record while operating a switch or manipulator for selectively switching between audio output of the analog record player 5 and audio output of the data reproduction apparatus 3, the performer is able to quickly switch between scratch sounds or reproduced sounds of the two audio sound sources by only operating the switch.

[0024]

(Second Embodiment)

FIG. 8 is a diagram illustrating a structure of a scratch reproduction system equipped with a rotation detection apparatus according to a second embodiment of the present invention. Note that like numerals are assigned to like parts as illustrated in FIGS. 1 to 7, and detailed description thereof is omitted.

As illustrated in FIG. 8, a rotation detection apparatus 11 includes a detecting section 12 and a switching section 13. The detecting section 12 includes an image sensor 12a, a delay circuit 12b, and a comparator 12c.

[0025]

The image sensor 12a is a sensor for capturing the analog record 4 in the form of image data. The image sensor 12a irradiates a label surface 4b or the like of the analog record 4 with light rays, receives the reflected light rays, and thus continually captures an image of the reflection plane in the form of the image data, and outputs the image data to the delay circuit 12b and the comparator 12c. The

delay circuit 12b is a circuit for delaying the image data by a preset length of time. The comparator 12c is a circuit for detecting the rotation speed and the rotation direction of the analog record 4 based on change of the image data. The comparator 12c compares the image data outputted from the image sensor 12a with the image data outputted from the delay circuit 12b, thereby calculating the rotation speed and the rotation direction.

[0026]

The switching section 13 is an electrical switch for switching between On and Off states of the detection operation of the detecting section 12 by On/Off switching for a pulse signal outputted from the comparator 12c. In addition to the effects of the first embodiment, the second embodiment achieves non-contact detection of the scratch operation performed on the analog record 4.

[0027]

(Other Embodiments)

The present invention is not limited to the above-described embodiments, but various variations or modifications are possible. Such variations and modifications also fall within the scope of the present invention.

(1) Although, in the above embodiments, the data reproduction apparatus 3 has been described by way of example, it is possible to control a parameter of another electronic device, such as a mixer or an effector, on a real-time basis in synchronization with the scratch operation on the analog record 4, thereby varying echo time, a center frequency, etc. Also note that, in the first embodiment, the supporting element 10a is rotated to switch between the On and Off states of the detection operation of the detecting section 9. However, an electrical switch or the like may be used for that switching.

[0028]

(2) In the first embodiment, the rotation speed and the rotation direction of the analog record 4 are detected using the rotation body 9a. However, a filter circuit or the like may be used to remove a specified frequency component from the

signal outputted from the detecting section 9 in order to prevent the audio data in the data reproduction apparatus 3 from being affected by a noise component owing to uneven rotation of the rotation body 9a. Also note that although, in the second embodiment, the image of the label surface 4b of the analog record 4 is captured, it is possible to capture an image of recording grooves of the analog record 4 with an increased resolution of the image sensor 12a.

[0029]

[Effects of the Invention]

As described above, according to the present invention, it is possible to easily control audio data in another electronic device using an analog record having audio data recorded thereon.

[Brief Description of the Drawings]

[FIG. 1]

A diagram illustrating the structure of a scratch reproduction system equipped with a rotation detection apparatus according to a first embodiment of the present invention.

[FIG. 2]

A diagram illustrating an analog record player to which the rotation detection apparatus according to the first embodiment of the present invention is attached. (A) is a plan view, and (B) is a front view.

[FIG. 3]

A perspective view of the rotation detection apparatus according to the first embodiment of the present invention.

[FIG. 4]

A plan view of the rotation detection apparatus according to the first embodiment of the present invention.

[FIG. 5]

A side view of the rotation detection apparatus according to the first embodiment of the present invention.

[FIG. 6]

A front view of the rotation detection apparatus according to the first embodiment of the present invention when it is in operation (ON) for detection.

[FIG. 7]

A front view of the rotation detection apparatus according to the first embodiment of the present invention when it is not in operation (OFF) for detection. FIG. 7(A) is a plan view illustrating the shape of a shell stand hole of a turntable, FIG. 7(B) is a front view of the rotation detection apparatus fitted into the shell stand hole, and FIG. 7(C) is a bottom plan view of the rotation detection apparatus.

[FIG. 8]

A diagram illustrating the structure of a scratch reproduction system equipped with a rotation detection apparatus according to a second embodiment of the present invention.

[Description of the Reference Numerals]

1: scratch reproduction system

2: optical disk

3: data reproduction apparatus

4: analog record

5: analog record player

5a: turntable

6: rotation detection apparatus

9: detecting section (detecting means)

9a: rotation body

9b: rotary encoder

10: switching section (switching means)

10a: supporting element

11: rotation detecting apparatus

12: detecting section (detecting means)

13: switching section (switching means)

12a: image sensor

12b: delay circuit

12c: comparator

P_1, P_2: rotary position

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FIG.1

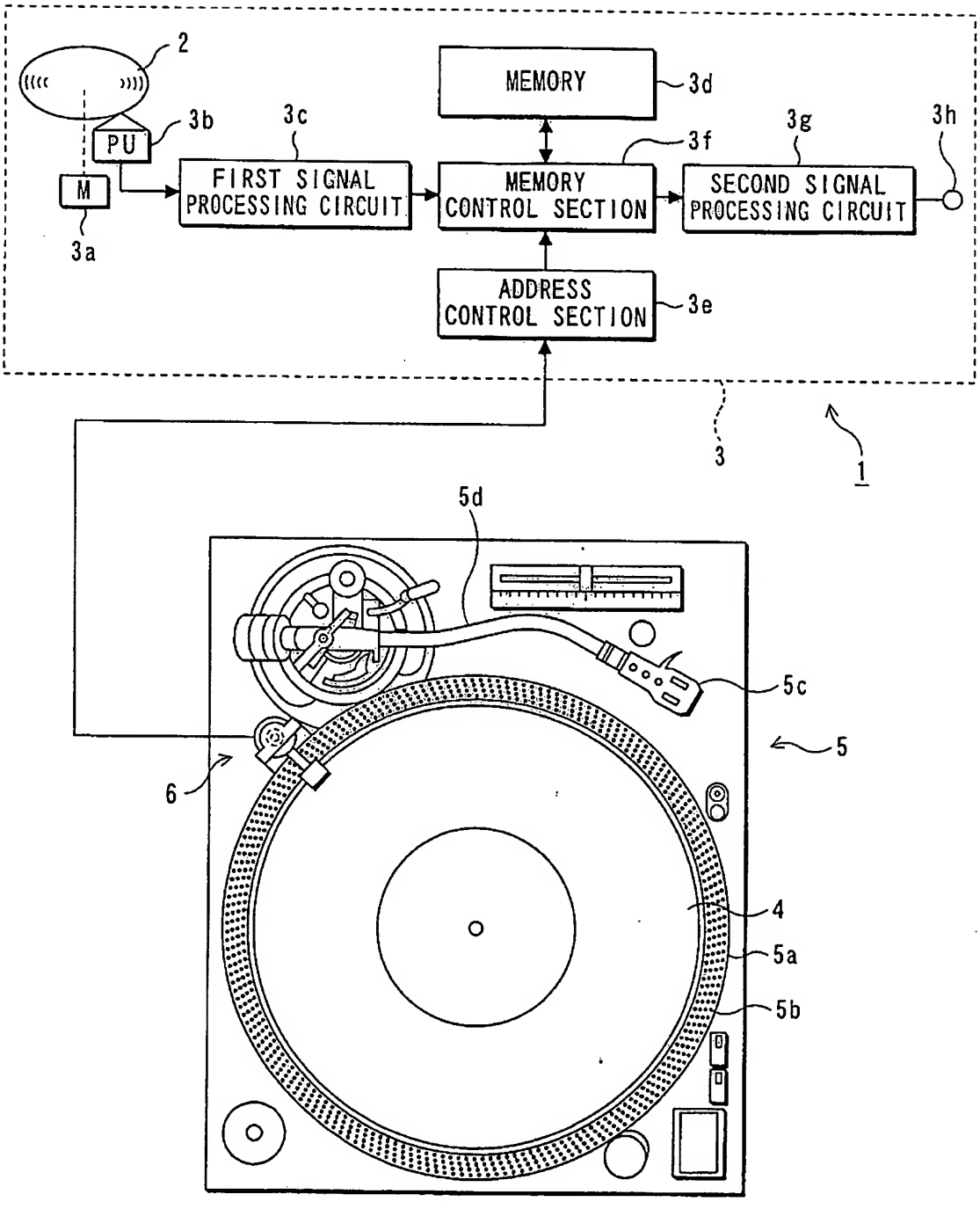


FIG.2(A)

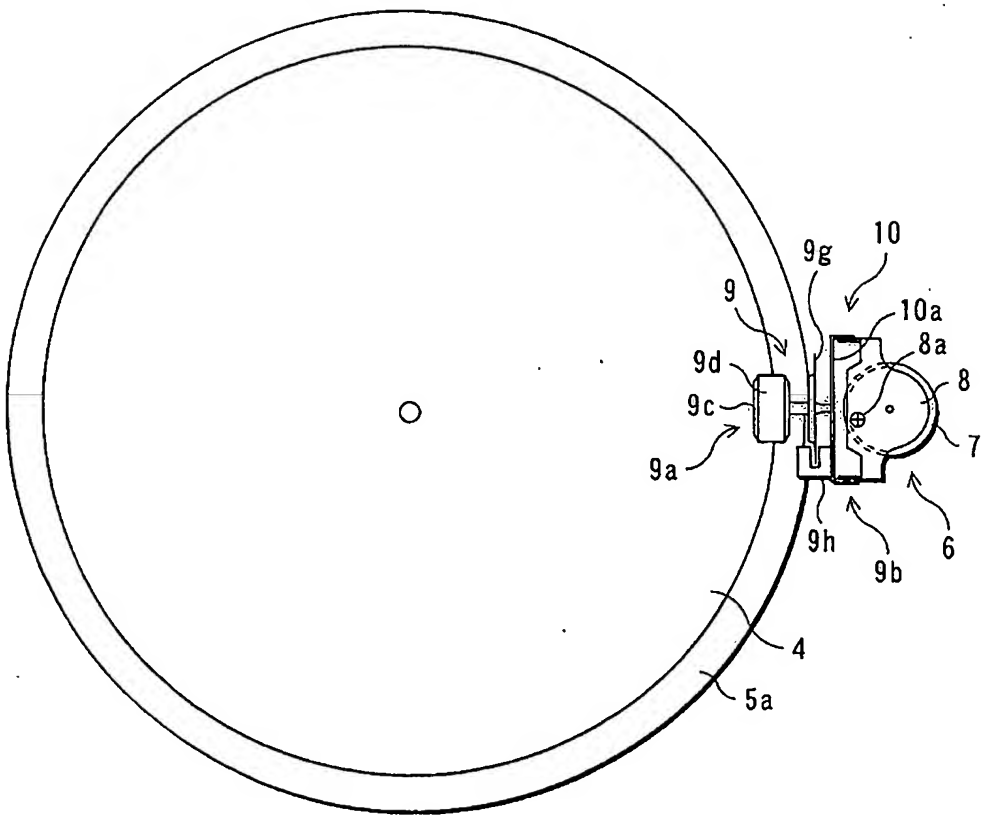

9g
10
9
10a
8a
9d
8
9c
7
9a
9h
9b
6
4
5a

FIG.2(B)

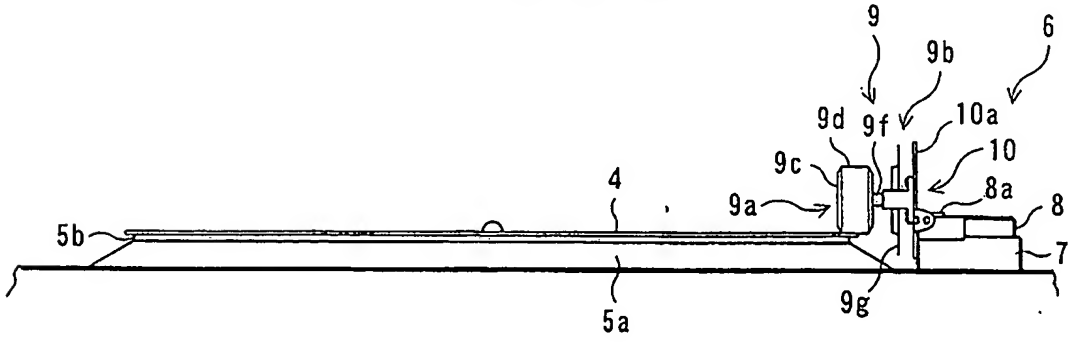

9
6
9b
9d
9f
10a
9c
10
4
8a
9a
8
5b
7
9g
5a

FIG.3

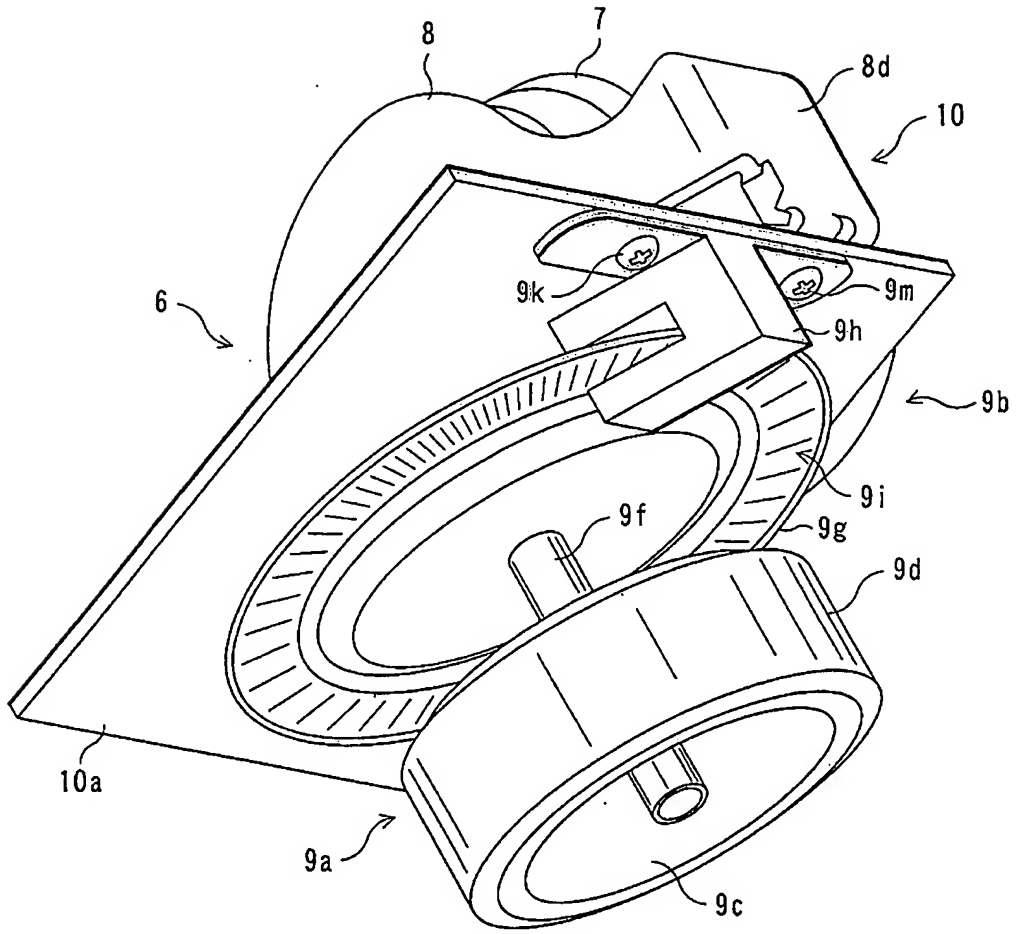


FIG.4

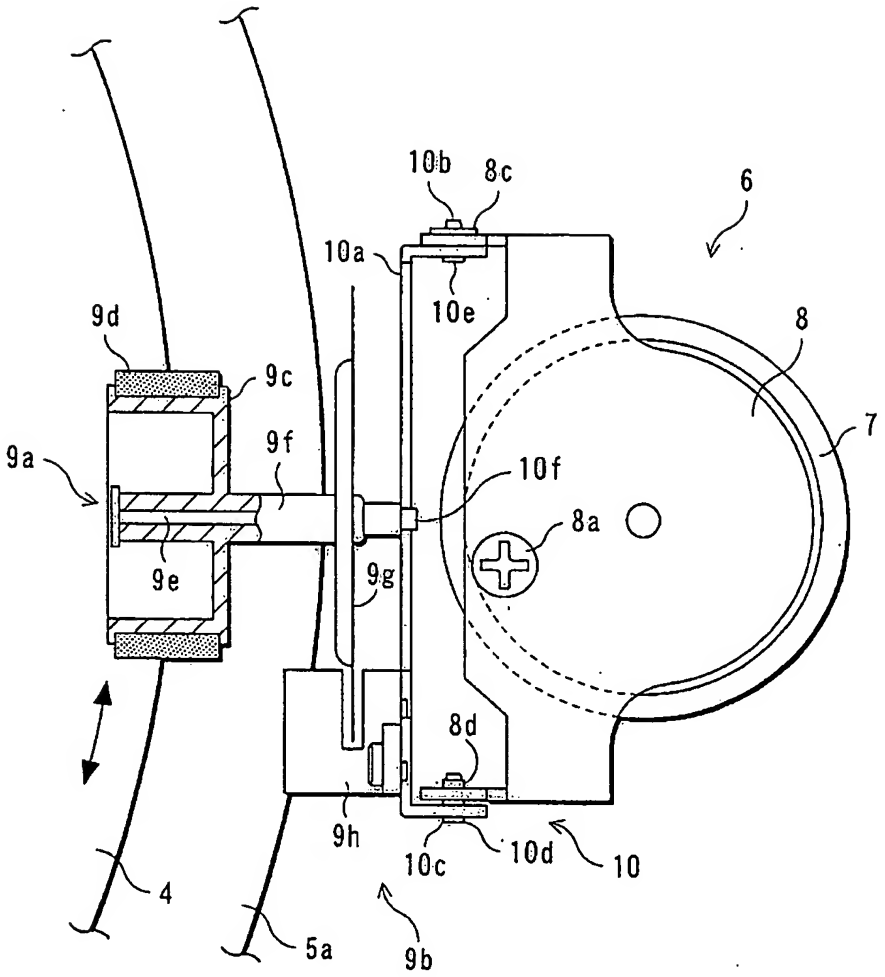


FIG.5

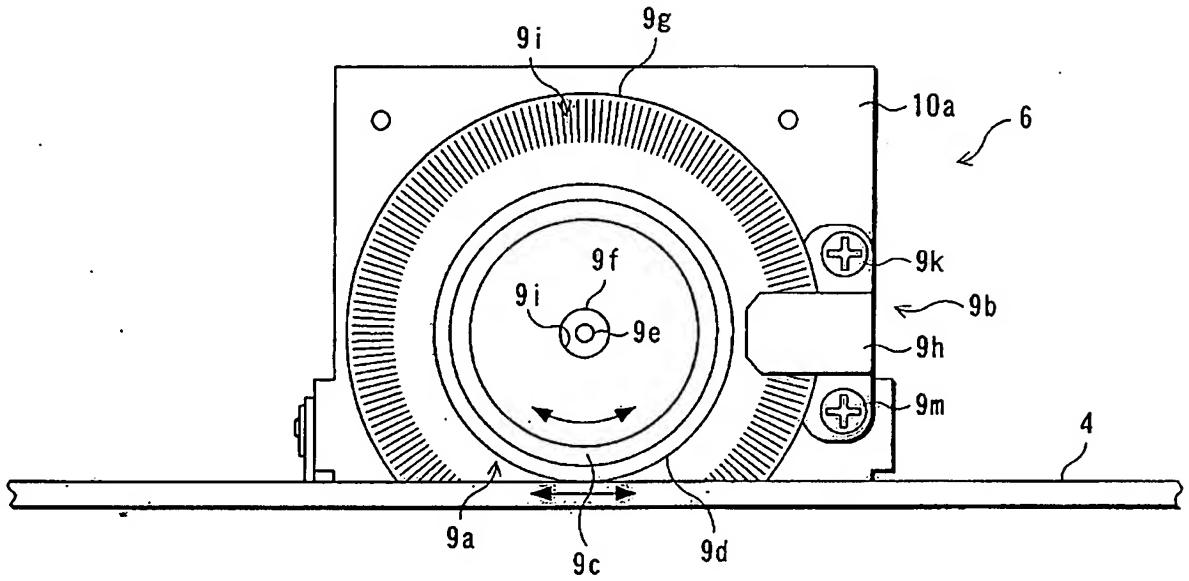


FIG.6

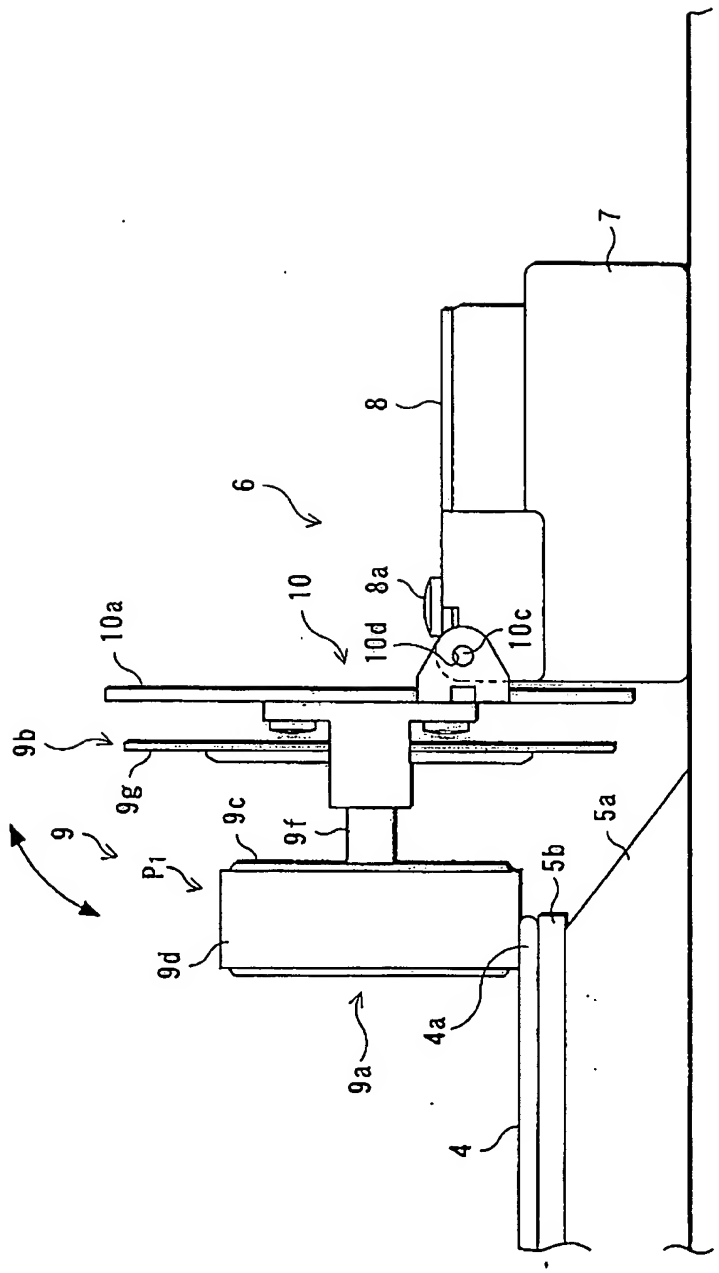


FIG.7(A)

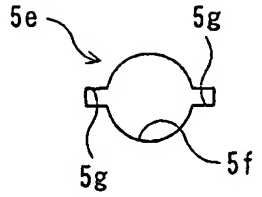


FIG.7(B)

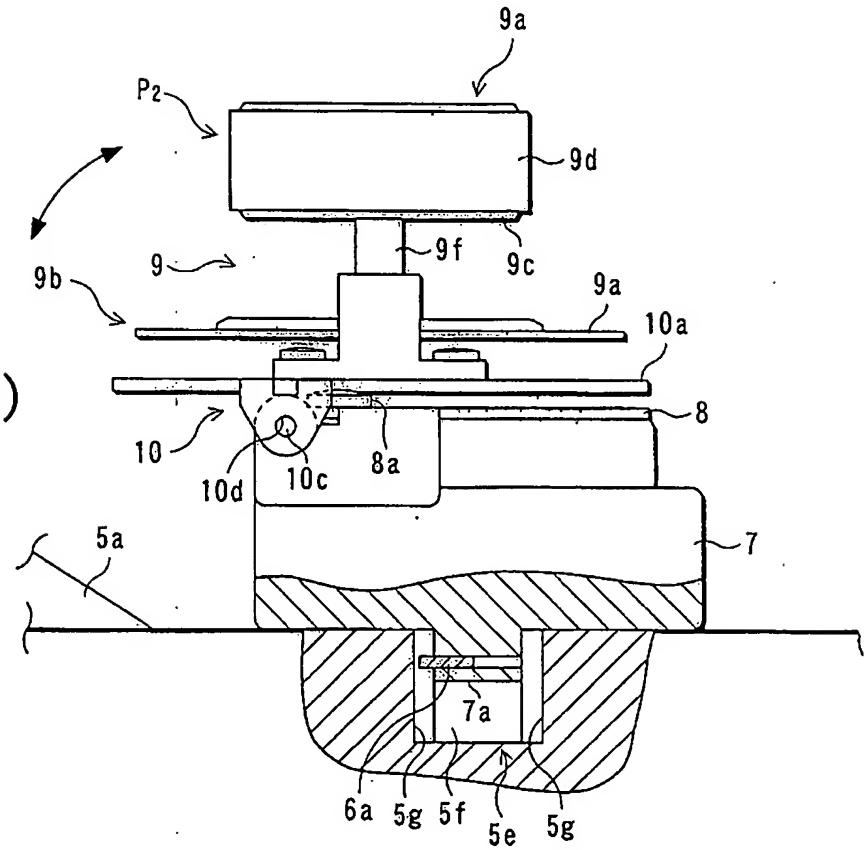


FIG.7(C)

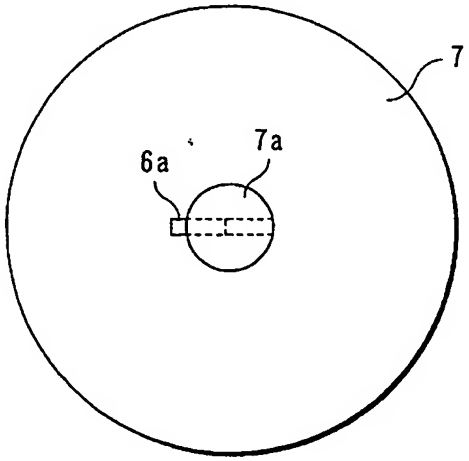
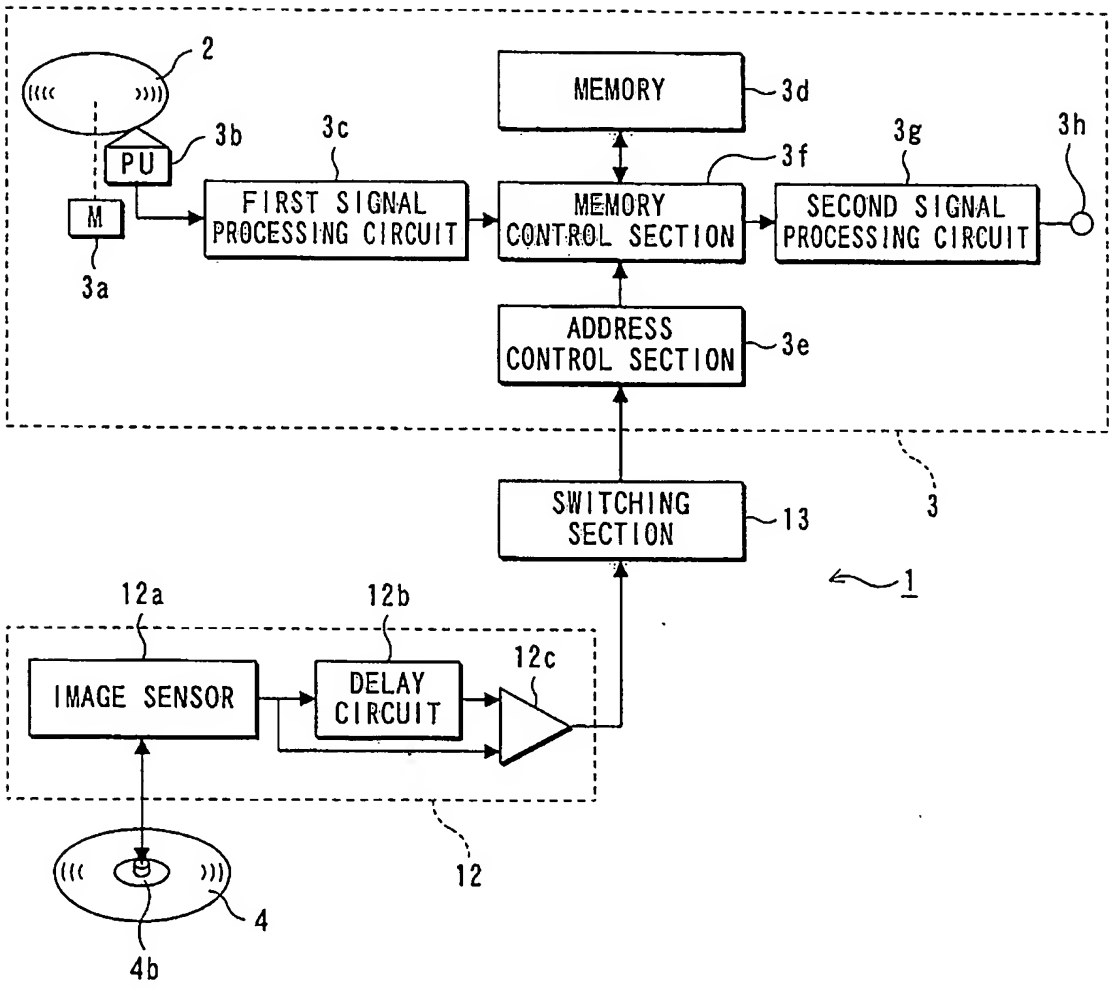


FIG.8


2
MEMORY
3d
3b
3c
3f
3g
3h
PU
FIRST SIGNAL PROCESSING CIRCUIT
MEMORY CONTROL SECTION
SECOND SIGNAL PROCESSING CIRCUIT
M
3a
ADDRESS CONTROL SECTION
3e
3
SWITCHING SECTION
13
1
12a
12b
12c
IMAGE SENSOR
DELAY CIRCUIT
12
4
4b

[Document Name] Abstract

[Abstract]

[Subject] To provide a rotation detection apparatus capable of easily controlling audio data in another electronic device using an analog record having audio data recorded thereon.

[Solving Means] As a result of rotating a supporting element 10a, a slip preventing element 9d is brought into close contact with a thick portion 4a of an analog record 4, and a rotation body 9a becomes capable of rotating in connection with the analog record 4 because of a frictional force between the slip preventing element 9d and the analog record 4. If a performer performs a scratch operation on the analog record 4 while reproducing the analog record 4, the rotation body 9a is rotated around a shaft 9e in accordance with the rotation of the analog record 4. A rotary encoder 9b detects a rotation speed and rotation direction of the rotation body 9a and outputs a pulse signal, and based on this pulse signal, audio data in a data reproduction apparatus 3 is subjected to scratch control.

[Selected Figure] FIG. 4